REMARKS/ARGUMENTS

The above Amendments and these Remarks are in reply to the Office Action mailed January 26, 2007.

I. Summary of the Examiner's Rejections

Prior to the Office Action mailed January 26, 2007, claims 1-75 were pending in the Application. In that Office Action, the specification was objected to as failing to provide proper antecedent basis for the claimed subject matter. The drawings were objected to because Figure 3 included label "hot/cold objects," and it was stated that hot objects were not properly disclosed in the specification. Claims 1-21 were rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. Claims 6, 13, 20, 27, 34, 41, 43-60, 64, 69, and 74 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 1-75 were rejected under 35 U.S.C. §112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. Claims 22, 29, and 36 were rejected under 35 U.S.C. §102 as being anticipated by Wolczko et al. (U.S. Patent No. 6,728,738). Claims 1-5, 7-12, 14-19, 21, 23-26, 28, 30-33, 35, 37-40, and 42 were rejected under 35 U.S.C. §103(a) as being unpatentable over Wolczko et al. (U.S. Patent No. 6,728,738) further in view of Arnold et al. (U.S. Patent No. 6,795,836). Claims 6, 13, 20, 27, 34, 41, and 43-75 were rejected under 35 U.S.C. §103(a) as being unpatentable over Wolczko et al. (U.S. Patent No. 6,728,738) in view of Arnold et al. (U.S. Patent No. 6,795,836), and further in view of Ryu et al. ("Garbage Collection for Distributed Persistent Objects").

II. Summary of Applicant's Amendments

The present Reply amends claims 1, 3, 6, 8, 10, 13, 15, 17, 20, 22, 24, 27, 29, 31, 34, 36, 38, 41, 43, 44, 49, 50, 55, 56, 61, 62, 66, 67, 71, and 72, leaving for the Examiner's present consideration claims 1-75. Reconsideration of the claims in light of the following arguments is respectfully requested. Applicants reserve the right to prosecute any originally presented or canceled claims in a continuing or future application.

III. Specification

The specification was objected to as failing to provide proper antecedent basis for the claimed subject matter. In particular, correction of the following was required: on page 8 line 23, "hot objects" and "hot clusters" were referenced without prior definitions. Paragraph [0020] has been amended to change "hot objects" and "hot clusters" to "warm objects" and "warm clusters," respectively. Applicants respectfully submit that the proposed amendments are to correct various informalities in the specification, and that no new matter is being added. Applicants respectfully submit that the specification as amended overcomes this objection.

IV. Drawings

The drawings were objected to because Figure 3 improperly included the label "hot/cold objects," as hot objects were not properly disclosed in the specification. Corrected drawing sheets in compliance with 37 C.F.R. 1.121(d) were required. A corrected drawing sheet for Figure 3 is submitted herewith that replaces the label "hot/cold objects' with "warm/cold objects," as well as "Hot 50," "Hot 62," and "Hot 68" with "Warm 50," "Warm 52," and "Warm 68," respectively. Applicants respectfully submit that the proposed amendments are to correct various informalities in the drawings, and that no new matter is being added. Applicants respectfully submit that the drawings are now in compliance with 37 C.F.R. 1.121(d).

V. Claims Rejected under 35 U.S.C. §112

In the Office Action, Claims 1-21 were rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. Claims 6, 13, 20, 27, 34, 41, 43-60, 64, 69, and 74 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 1-75 were rejected under 35 U.S.C. §112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps.

Claims 1-21

Claims 1-21 were rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. In the Office Action, it was stated that the claim(s) contained subject matter, which was not described in the specification in

such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 1, 8, and 15 recite the limitation of "determines the status of warm objects and cold objects." In the Office Action, it was correctly stated that the terms "warm" or "cold" are used as status of an object. Accordingly, claims 1, 8, and 15 have been amended to require setting "the status of the object to warm" and "the status of the object to cold." Claims 2-7, 9-14, and 16-21 do not further limit "status," and thus amendments to these claims are not necessary. Applicants respectfully submit that claims 1-21 now properly conform to the requirements of 35 U.S.C. §112, and reconsideration thereof is respectfully requested.

Claims 6, 13, 20, 27, 34, 41, 43-60, 64, 69, and 74

Claims 6, 13, 20, 27, 34, 41, 43-60, 64, 69, and 74 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 6, 13, 20, 27, 34, 41, 64, 69, and 74 recite the limitation "the limiting time" in "wherein the limiting time." In the Office Action, it was stated that there was insufficient antecedent basis for this limitation in these claims. All of the independent claims 1, 8, 15, 22, 29, 36, 43, 49, 55, 61, 66, and 71 have been amended to require accepting "as input from a system developer a value for a limiting time." Thus, claims 6, 13, 20, 27, 34, 41, 64, 69, and 74, each of which depend from an amended independent claim, now have sufficient antecedent basis for this limitation in these claims.

Regarding claims 43-60, claims 43, 49, and 55 recite the limitation "recently accessed." In the Office Action, it was stated that this limitation is a relative term which rendered these claims indefinite. Claims 43, 49, and 55 have been amended to remove the limitation "recently accessed." Further, claims 44-48, 50-54, and 56-60 do not require the limitation of "recently accessed." Thus, claims 43-60 no longer require a relative term which renders these claims indefinite.

Applicants respectfully submit that claims 6, 13, 20, 27, 34, 41, 43-60, 64, 69, and 74 now properly conform to the requirements of 35 U.S.C. §112, and reconsideration thereof is respectfully requested.

Claims 1-75

Claims 1-75 were rejected under 35 U.S.C. §112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. In the Office Action, it was stated that the claim language of all independent claims 1, 8, 15, 22, 29, 36, 43, 49, 55, 61, 66, and 71 failed to include the steps of how warm/cold objects and/or links are determined. It was stated that the language as presented does not define warm/cold objects as disclosed in the specification. For links, the claim language needed to further clarify how the links were established as disclosed in the disclosure, for example, page 8 and Figure 3, for links between warm/cold objects or clusters.

The independent claims have been amended to define warm/cold objects as disclosed in the specification. (Spec., p. 8, para. 0020, lines 18-22). Similarly, the independent claims have been amended to require links from any of the warm objects to any of the cold objects. (Spec., p. 8, para. 0020, lines 23-25). Because claims 2-7, 9-14, 16-21, 23-28, 30-35, 37-42, 44-48, 50-54, 56-60, 62-65, 67-70, and 72-75 each depend from an independent claim that is no longer incomplete for omitting essential steps, these dependent claims do not need to be amended. Thus, claims 1-75 are no longer incomplete for omitting essential steps. Applicants respectfully submit that claims 1-75 now properly conform to the requirements of 35 U.S.C. §112, and reconsideration thereof is respectfully requested.

VI. Claims Rejected under 35 U.S.C. §102(a)

Claims 22, 29, and 36 were rejected under 35 U.S.C. §102(a) as being anticipated by Wolczko et al. (U.S. Patent No. 6,728,738).

Claim 22

Claim 22 has been amended by the present Response to more clearly define the embodiment of the invention therein. As amended, claim 22 defines:

> 22. (Currently amended) A system for detecting memory leaks in an application server or run-time environment comprising:
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> a virtual machine executing within said run-time environment;
>
> a memory space within said run-time environment for storing objects in memory, for use by a software application; and,
>
> a temperature analyzer that accepts as input from a system developer a value for a limiting time,
>
> wherein the temperature analyzer determines for each object whether the object has persisted in memory without being accessed or

referenced for a length of time greater than the limiting time, wherein if the length of time is greater than the limiting time, the object is marked as cold, and if the length of time is less than the limiting time, the object is marked as warm, and

wherein the temperature analyzer determines links from any of the warm objects to any of the cold objects, for use by the system developer in detecting memory leaks.

Claim 22 defines that a temperature analyzer accepts as input from a system developer a value for a limiting time, wherein the temperature analyzer determines for each object whether the object has persisted in memory without being accessed or referenced for a length of time greater than the limiting time, wherein if the length of time is greater than the limiting time, marking the object as cold, and if the length of time is less than the limiting time, marking the object as warm, and wherein the temperature analyzer determines links from any of the warm objects to any of the cold objects, for use by the system developer in detecting memory leaks. Applicants respectfully submit that these features are not disclosed by Wolczko.

Wolczko discloses fast lifetime analysis of objects in a garbage-collected system. Stored with each object is a reference count, which is a value that indicates the number of incoming pointers to the object. Wolczko uses reference counts to identify dead cycles of objects. In a dead cycle, each object points to another object in the cycle, but no incoming links enter the cycle itself. Any objects in a dead cycle are garbage. (col. 3, lines 42-43, 50-65, and Fig. 3 element 300).

Claim 22 has been amended to more clearly define determining whether objects are warm or cold. Wolczko discloses reference counting for each object. Reference counting as disclosed in Wolczko, however, does not involve making a determination of whether objects are warm or cold, as required by claim 22. Further, claim 22 has been amended to more clearly define determining links from any of the warm objects to any of the cold objects. Wolczko determines whether an incoming link enters a cycle of objects. The determination of no incoming link to a cycle of objects in order to find a dead cycle of objects as disclosed in Wolczko, however, is not the same as determining a link from a warm object to a cold object, as required by claim 22. Further, claim 22 has been amended to more clearly define a limiting time, and accepting as input from a system developer a value for a limiting time. Wolczko, on the other hand, does not involve input from a system developer, as required by claim 22.

As such, Applicants respectfully submit that Wolczko fails to teach or suggest that a temperature analyzer accepts as input from a system developer a value for a

limiting time, determines for each object whether the object is warm or cold, and determines links from any of the warm objects to any of the cold objects, for use by the system developer in detecting memory leaks, as required by claim 22. Applicants respectfully submit that the embodiment defined by claim 22 is neither anticipated by nor obvious in view of Wolczko, and respectfully request reconsideration of the claim.

Claims 29 and 36

The comments provided above with respect to claim 22 are hereby incorporated by reference. Claims 29 and 36 have been similarly amended to more clearly define the embodiments of the invention therein. Applicants respectfully submit that the embodiments defined by claims 29 and 36 are neither anticipated by nor obvious in view of Wolczko, and respectfully request reconsideration of these claims.

VII. Claims Rejected under 35 U.S.C. §103(a)

Claims 1-5, 7-12, 14-19, 21, 23-26, 28, 30-33, 35, 37-40, and 42 were rejected under 35 U.S.C. §103(a) as being unpatentable over Wolczko et al. (U.S. Patent No. 6,728,738) further in view of Arnold et al. (U.S. Patent No. 6,795,836).

Claims 1, 8, and 15

The comments provided above with respect to claim 22 are hereby incorporated by reference. Claims 1, 8, and 15 have been similarly amended to more clearly define the embodiments of the invention therein. Applicants respectfully submit that the embodiments defined by claims 1, 8, and 15 are similarly neither anticipated by nor obvious in view of Wolczko or Arnold, taken alone or in combination, and respectfully request reconsideration of these claims.

Claims 2, 9, 16, 23, 30, and 37

Claims 2, 9, 16, 23, 30, and 37 require an object clusterer for clustering groups of warm objects to form warm clusters, and groups of cold objects to form cold clusters. The comments provided above with respect to claim 22 are hereby incorporated by reference. As discussed above for claim 22, Wolczko does not teach or suggest determining whether objects are warm or cold. Thus, for similar reasons, Wolczko does not disclose clustering of warm objects to form warm clusters, and groups of cold objects to form cold clusters. Thus, Applicants respectfully submit that the embodiments defined

by these claims are neither anticipated by nor obvious in view of Wolczko or Arnold, taken alone or in combination, and respectfully request reconsideration of these claims.

Claims 3, 10, 17, 24, 31, and 38

Claims 3, 10, 17, 24, 31, and 38 require that the links include any or both of warm object – cold object links and warm cluster – cold cluster links. The comments provided above with respect to claims 2 and 22 are hereby incorporated by reference. As discussed above for claim 22, Wolczko does not teach or suggest determining whether objects are warm or cold, nor determining links from any of the warm objects to any of the cold objects. As discussed above for claim 2, Wolczko does not teach or suggest clustering of objects. Thus, for similar reasons, Wolczko does not disclose that the links include any or both of warm object – cold object links and warm cluster – cold cluster links. Thus, Applicants respectfully submit that the embodiments defined by these claims are neither anticipated by nor obvious in view of Wolczko or Arnold, taken alone or in combination, and respectfully request reconsideration of these claims.

Claims 4, 5, 7, 11, 12, 14, 18, 19, 21, 25, 26, 28, 32, 33, 35, 39, 40, and 42

Claims 4, 5, 7, 11, 12, 14, 18, 19, 21, 25, 26, 28, 32, 33, 35, 39, 40, and 42 are not addressed separately, but it is respectfully submitted that these claims are allowable in view of the comments provided above. Applicants respectfully submit that these claims are similarly neither anticipated by nor obvious in view of the cited references, and reconsideration thereof is respectfully requested. It is also submitted that these claims also add their own limitations which render them patentable in their own right. Applicants respectfully reserve the right to argue these limitations should it become necessary in the future.

Claims 6, 13, 20, 27, 34, 41, and 43-75 were rejected under 35 U.S.C. §103(a) as being unpatentable over Wolczko et al. (U.S. Patent No. 6,728,738) in view of Arnold et al. (U.S. Patent No. 6,795,836), and further in view of Ryu et al. ("Garbage Collection for Distributed Persistent Objects").

Claim 6

Claim 6 requires that the limiting time of determining whether an object is warm or cold can be adjusted by the developer to better distinguish between warm and cold objects or warm and cold clusters.

Ryu discloses garbage collection for distributed persistent objects. When an object is created by a client, the client assigns a time-to-live to the object. The new object also gets an expiration time which is the creation time plus the time-to-live. Claim 6 requires a limiting time, which is a length of time used to measure how long an object has persisted in memory without being accessed or referenced. As disclosed in Ryu, an object's time-to-live, which determines when an object will expire, however, is different than the limiting time required in claim 6. Further, in Ryu, a time-to-live is assigned by a client, not a system developer, as required by claim 6, and Ryu also does not disclose adjustment of the time-to-live by the developer. Therefore, Ryu does not anticipate nor suggest that the limiting time of determining whether an object is warm or cold can be adjusted by the developer to better distinguish between warm and cold objects or warm and cold clusters.

Thus, Applicants respectfully submit that the embodiment defined by claim 6 is neither anticipated by nor obvious in view of Wolczko, Arnold, or Ryu, taken alone or in combination, and respectfully request reconsideration of this claim.

Claims 13, 20, 27, 34, and 41

The comments provided above with respect to claim 6 are hereby incorporated by reference. Applicants respectfully submit that the embodiments defined by claims 13, 20, 27, 34, and 41 are similarly neither anticipated by nor obvious in view of Wolczko, Arnold, or Ryu, taken alone or in combination, and respectfully request reconsideration of these claims.

Claim 43

Claim 43 has been amended by the present Response to more clearly define the embodiment of the invention therein. As amended, claim 43 defines:

> 43. (Currently amended) A system for providing potential memory leak information in a run-time environment, comprising:
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> an object temperature analyzer that accepts as input from a system developer a value for a limiting time, wherein the object temperature analyzer determines for each object whether the object has persisted in memory without being accessed or referenced for a length of time greater than the limiting time,

wherein if the length of time is greater than the limiting time the object temperature analyzer marks the object as cold, and if the length of time is less than the limiting time the object temperature analyzer marks the object as warm;

an object clusterer that clusters groups of warm objects to form warm clusters and groups of cold objects to form cold clusters; and

an object map that identifies links from any of the warm objects in any of the warm clusters to any of the cold objects in any of the cold clusters to assist the system developer in determining potential memory leaks.

Claim 43 defines that an object temperature analyzer that accepts as input from a system developer a value for a limiting time. This limiting time is used to determine whether for each object the object has persisted in memory without being accessed or referenced for a length of time greater than the limiting time. If this length of time is greater than the limiting time, the object is marked as a cold object. If this length of time is less than the limiting time, the object is marked as a warm object. An object clusterer clusters groups of warm objects to form warm clusters and groups of cold objects to form cold clusters. Finally, an object map assists the system developer in determining potential memory leaks.

Ryu discloses garbage collection for distributed persistent objects. Each object maintains a Last Referenceable TimeStamp (LRTS) which indicates the most recent time when the object was accessible by clients. The LRTS is propagated to all reachable objects recursively when links are refreshed. All reachable objects from the accessed object will get new LRTSs eventually. Objects whose LRTSs are not more recent than a local threshold are local garbage. (p. 3, para. 5). Before a local garbage object is reclaimed, however, all referencing objects are examined to see whether they are garbage or not. If all referencing objects are garbage, then the object is also garbage and can be reclaimed.

Claim 43 has been amended to more clearly define determining whether objects are warm or cold. In claim 43, only those objects that are actually accessed or referenced will have access time information updated. Ryu discloses propagating the LRTS of an object to all reachable objects from the accessed object, thus setting these reachable objects to more recent access times. In claim 43, because access time information for an accessed object is not propagated to all its reachable objects, the number of objects determined to be "cold" will likely be larger than the number of objects determined to be "local garbage" as disclosed in Ryu. Thus, the determination of whether objects are local garbage or not as disclosed in Ryu is not the same as the determination of whether objects are warm or cold, as required by claim 43.

Further, claim 43 requires clustering groups of warm objects to form warm clusters and groups of cold objects to form cold clusters. Ryu discloses determining whether objects are local garbage or not. Ryu, however, does not disclose forming "clusters" of local garbage or "clusters" of remaining objects, as required by claim 43.

Further claim 43 has been amended to more clearly define a limiting time, and accepting as input from a system developer a value for a limiting time. Ryu, on the other hand, does not involve input from a system developer, as required by claim 43. Further, claim 43 requires that the object map assists the system developer in determining potential memory leaks. The object map includes links from any of the warm objects in any of the warm clusters to any of the cold objects in any of the cold clusters. This information is displayed to the user who can then investigate memory leaks. The method disclosed in Ryu, on the other hand, is automatic in determining a final list of local garbage and does not require assisting a system developer in determining potential memory leaks, as required by claim 43.

Further, claim 43 provides potential memory leak information in a run-time environment. Ryu discloses a garbage collection method for persistent objects. Thus, the garbage collection method for persistent objects as disclosed in Ryu is different than a garbage collection method for objects created in a run-time environment, as required by claim 43.

As such, Applicants respectfully submit that Ryu fails to teach or suggest providing potential memory leak information in a run-time environment with an object temperature analyzer that accepts as input from a system developer a value for a limiting time, wherein the object temperature analyzer determines whether objects are warm or cold based on access times of objects actually accessed; an object clusterer that clusters groups of warm objects to form warm clusters and groups of cold objects to form cold clusters; and an object map to assist the system developer in determining potential memory leaks.

Thus, Applicants respectfully submit that the embodiment defined by claim 43 is neither anticipated by nor obvious in view of Wolczko, Arnold, or Ryu, taken alone or in combination, and respectfully request reconsideration of this claim.

Claims 49 and 55

The comments provided above with respect to claim 43 are hereby incorporated by reference. Claims 49 and 55 have been similarly amended to more clearly define the

embodiments of the invention therein. Applicants respectfully submit that the embodiments defined by claims 49 and 55 are similarly neither anticipated by nor obvious in view of Wolczko, Arnold, or Ryu, taken alone or in combination, and respectfully request reconsideration of these claims.

Claims 44, 50, 56, 62, 67, and 72

The comments provided above with respect to claim 3 are hereby incorporated by reference. Applicants respectfully submit that the embodiments defined by claims 44, 50, 56, 62, 67, and 72 are similarly neither anticipated by nor obvious in view of Wolczko, Arnold, or Ryu, taken alone or in combination, and respectfully request reconsideration of these claims.

Claims 47, 53, 59, 64, 69, and 74

The comments provided above with respect to claim 6 are hereby incorporated by reference. Applicants respectfully submit that the embodiments defined by claims 47, 53, 59, 64, 69, and 74 are similarly neither anticipated by nor obvious in view of Wolczko, Arnold, or Ryu, taken alone or in combination, and respectfully request reconsideration of these claims.

Claims 45, 46, 48, 51, 52, 54, 57, 58, 60, 63, 65, 68, 70, 73, and 75

Claims 45, 46, 48, 51, 52, 54, 57, 58, 60, 63, 65, 68, 70, 73, and 75 are not addressed separately, but it is respectfully submitted that these claims are allowable in view of the comments provided above. Applicants respectfully submit that these claims are similarly neither anticipated by nor obvious in view of the cited references, and reconsideration thereof is respectfully requested. It is also submitted that these claims also add their own limitations which render them patentable in their own right. Applicants respectfully reserve the right to argue these limitations should it become necessary in the future.

Claims 61, 66, and 71

The comments provided above with respect to claim 43 are hereby incorporated by reference. Claims 61, 66, and 71 have been similarly amended to more clearly define the embodiments of the invention therein. Applicants respectfully submit that the embodiments defined by claims 61, 66, and 71 are similarly neither anticipated by nor

obvious in view of Wolczko, Arnold, or Ryu, taken alone or in combination, and respectfully request reconsideration of these claims.

VIII. Conclusion

In light of the above, it is respectfully submitted that all of the claims now pending in the subject patent application should be allowable, and reconsideration of the claims is respectfully requested. The Examiner is respectfully requested to telephone the undersigned if they can assist in any way in expediting issuance of a patent.

Enclosed is a PETITION FOR EXTENSION OF TIME UNDER 37 C.F.R. §1.136 for the time to respond up to and including May 29, 2007.

The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 06-1325 for any matter in connection with this response, including any fee for extension of time, which may be required.

Respectfully submitted,

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